

New Hampshire Volunteer Lake Assessment Program

2003 Biennial Report for Back Lake Pittsburg



NHDES
Water Division
Watershed Management Bureau
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OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **BACK LAKE, PITTSBURG**, the program coordinators have made the following observations and recommendations:

Welcome back to the New Hampshire Volunteer Lake Assessment Program! According to our records, Back Lake was sampled through VLAP in 1991. This data has been included in this report.

As your group continues to participate in VLAP over the years, the database created for your lake/pond will help your monitoring group track water quality trends and will ultimately enable your group and DES to identify potential sources of pollutants from the watershed that may affect lake/pond quality.

Due to your distance from Concord, DES was happy to conduct two sampling visits to your lake this summer. We hope that we will be able to continue to provide you with additional biologist visits in future sampling years. We understand that future sampling will depend upon volunteer availability, DES' ability to conduct additional sampling visits, and your group's water monitoring goals and funding availability. We would like to point out that **water quality trend analysis is not feasible with only a few data points**. It will take many years to develop a statistically sound set of water quality baseline data. Specifically, after 10 consecutive years of participation in the program, we will be able to analyze the in-lake data with a simple statistical test to determine if there has been a significant change in the annual mean chlorophyll-a concentration, Secchi-disk transparency reading, and phosphorus concentration. Therefore, frequent and consistent sampling will ensure useful data for future analyses.

Please contact the VLAP Coordinator early this spring to schedule the annual DES lake visit. **It would be best to schedule the DES visit for early June to refresh your sampling skills!**

Finally, please remember that one of your most important responsibilities as a volunteer monitor is to educate your association, community, and town officials about the quality of your lake/pond and what can be done to protect it!

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity.

The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.

The current year data (the top graph) show that the chlorophyll-a concentration **increased slightly** from July to September. The chlorophyll-a concentration on each sampling event was **much less than** the state mean.

Visual inspection of the prepared historical data trend line (the bottom graph) shows **a slightly increasing** in-lake chlorophyll-a trend, meaning that the chlorophyll-a concentration has **slightly worsened** since monitoring was originally initiated in 1991.

However, it is important to point out that this trend is based on only two years worth of data that are separated by eleven years during which the lake was not sampled. Therefore, this trend may not accurately reflect the change in lake quality over time. After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency

data for each sampling season that the lake/pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

The current year data (the top graph) show that the in-lake transparency **increased slightly** from July to September. The transparency on both sampling events was **less than** the state mean.

Again, although we have prepared a graph from the data points collected, it is important to point out that this data is not complete and includes only two data points. Therefore this does not give a true representative trend line for the data. However, visual inspection of the prepared historical data trend line (the bottom graph) shows **a slightly decreasing** in-lake transparency trend, meaning that the transparency has **slightly worsened** since 1991.

Again, since this trend is based on only two years worth of data that are separated by eleven years during which the lake was not sampled, it may not accurately reflect the change in lake quality over time. As discussed previously, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean.

It is important to point out that as the chlorophyll has **slightly increased (worsened)** since 1991, the transparency has **slightly decreased (worsened)**. We generally expect this inverse relationship in lakes. As the amount of algal cells in the water increases, it is more difficult for light to penetrate into the water column.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **increased slightly** July to September. The phosphorus concentration on both sampling events was **slightly greater than** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **decreased slightly** from July to September. The phosphorus concentration on both sampling events was **less than** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows a **relatively stable** phosphorus trend, which means that the concentration has **remained approximately the same** in the epilimnion since monitoring began. However, it is important to point out that this is not a true trend line, as it includes only two data points, and these points were collected over ten years apart.

Overall, visual inspection of the historical data trend line for the hypolimnion shows **a slightly decreasing** phosphorus trend, which means that the concentration has **slightly improved** in the hypolimnion since monitoring began. Again, however, it is important to point out that this may not be a true trend line, as it includes only two data points, and these points were collected over ten years apart.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION

➤ **Table 2: Phytoplankton**

Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the lake/pond. The dominant phytoplankton species observed in July were ***Anabaena* (cyanobacteria), *Chroococcus* (cyanobacteria), *Dinobryon* (golden-brown) and *Microcystis* (cyanobacteria)**. The dominant phytoplankton species observed in September were ***two unidentifiable species of cyanobacteria*, and *Dinobryon* (golden-brown)**.

Phytoplankton populations undergo a natural succession during the growing season (Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire’s less productive lakes and ponds.

During the July and September sampling visits, the majority of plankton species observed were cyanobacteria. An overabundance of cyanobacteria (previously referred to as blue-green algae) indicates that there may be an excessive total phosphorus concentration in the lake/pond, or that the ecology is out of balance. Some species of cyanobacteria can be toxic to livestock, pets, wildlife, and humans. (Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding cyanobacteria).

The presence of cyanobacteria serves as a reminder of the lake’s/pond’s delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading into the lake/pond by eliminating fertilizer use on lawns, keeping the lake/pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the lake/pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria (blue-green algae) have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to “pile” cyanobacteria into scums that accumulate in one section of the lake/pond. If a fall bloom occurs, please contact the VLAP Coordinator.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH at the deep spot this season ranged from **7.18** in the hypolimnion to **7.21** in the epilimnion, which means that the water is ***approximately neutral***.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire's lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are "highly sensitive" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) was 14.60 mg/L and in 1991 it was 10.60 mg/L. This means that the lake has a low vulnerability to acidic inputs (such as acid precipitation).

➤ **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire's lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The conductivity has ***increased*** in the lake/pond and **Outlet** since monitoring began in 1991. In addition, the in-lake conductivity (approximately 73 uMhos/cm) is ***greater than*** the state mean. Typically, sources of increased conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and

the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

➤ **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The total phosphorus in the Outlet (15 ug/L) was relatively low this season.

Back Lake is primarily a wetland and groundwater-fed lake. However, in 1991, a station identified as "Driftwood Inlet" was sampled. This station was not sampled in 2003. Since the total phosphorus concentration of the Driftwood Inlet was elevated in 1991 (31 ug/L), it would be helpful to locate and sample this inlet during the 2004 sampling season.

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The dissolved oxygen concentration was **high** at all depths sampled at the deep spot of the lake/pond. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

➤ **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is

strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

A “Sampling Procedures Assessment Audit” was not conducted for your monitoring group this summer, due to the fact that a biologist assisted with both sampling events. During the 2004 sampling season, a biologist will conduct a visit during for your first sampling event, in order to provide more training.

NOTES

- **Biologist’s Note (7/2/03):** Some drifting occurred while at the deep spot.

USEFUL RESOURCES

Acid Deposition Impacting New Hampshire’s Ecosystems, ARD-32, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/ard/ard-32.htm.

Aquarium Plants and Animals: Don’t leave them stranded. Informational pamphlet sponsored by NH Fish and Game, Aquaculture Education and Research Center, and NHDES (603) 271-3505.

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503.

A Boater’s Guide to Cleaner Water, NHDES pamphlet, (603) 271-3503.

Camp Road Maintenance Manual: A Guide for Landowners. Kennebec Soil and Water Conservation District, 1992, (207) 287-3901.

Comprehensive Shoreland Protection Act, RSA 483-B, WD-SP-5, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-5.htm.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-1.htm

OBSERVATIONS AND RECOMMENDATIONS

2003

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm

Iron Bacteria in Surface Water, WD-BB-18, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-18.htm

Is it Safe to Eat the Fish We Catch? Mercury and Other Pollutants in Fish, NH Department of Health and Human Services pamphlet, 1-800-852-3345, ext. 4664.

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf.

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-2.htm.

Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm.

Sand Dumping - Beach Construction, WD-BB-15, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-15.htm.

Swimmers Itch, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-2.htm.

Through the Looking Glass: A Field Guide to Aquatic Plants. North American Lake Management Society, 1988, (608) 233-2836 or www.nalms.org.

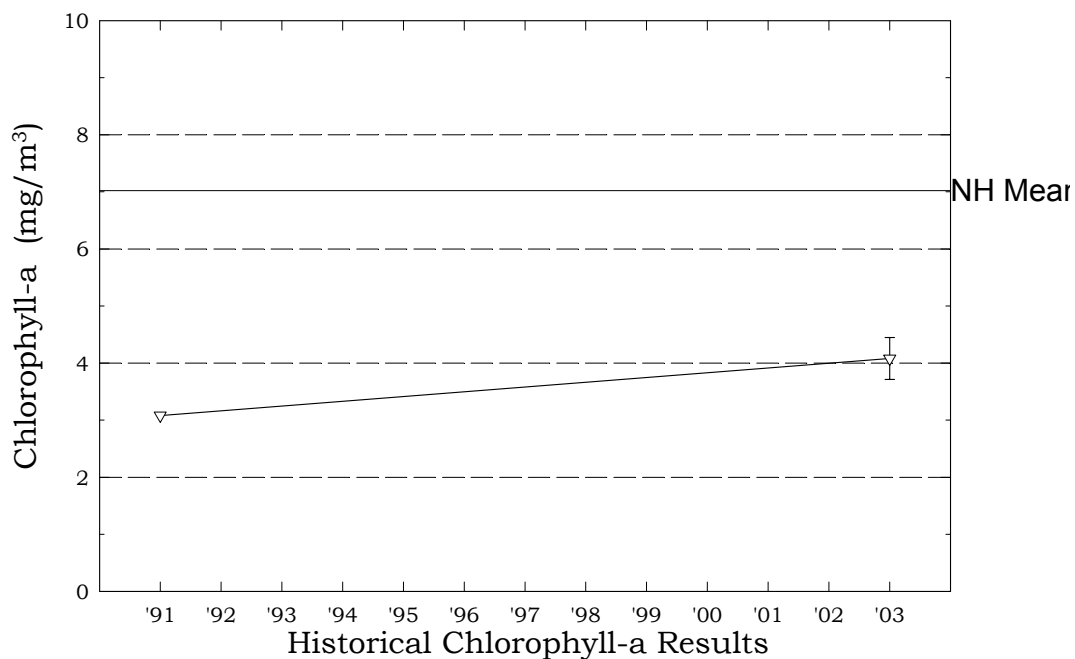
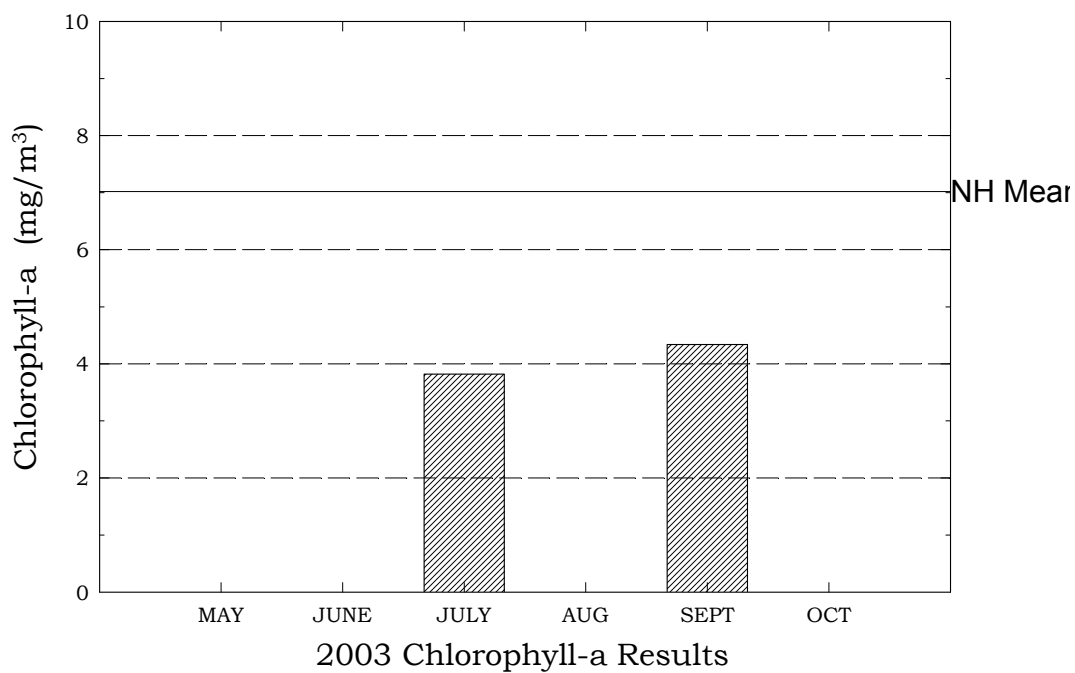
Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-4.htm.

APPENDIX A

GRAPHS

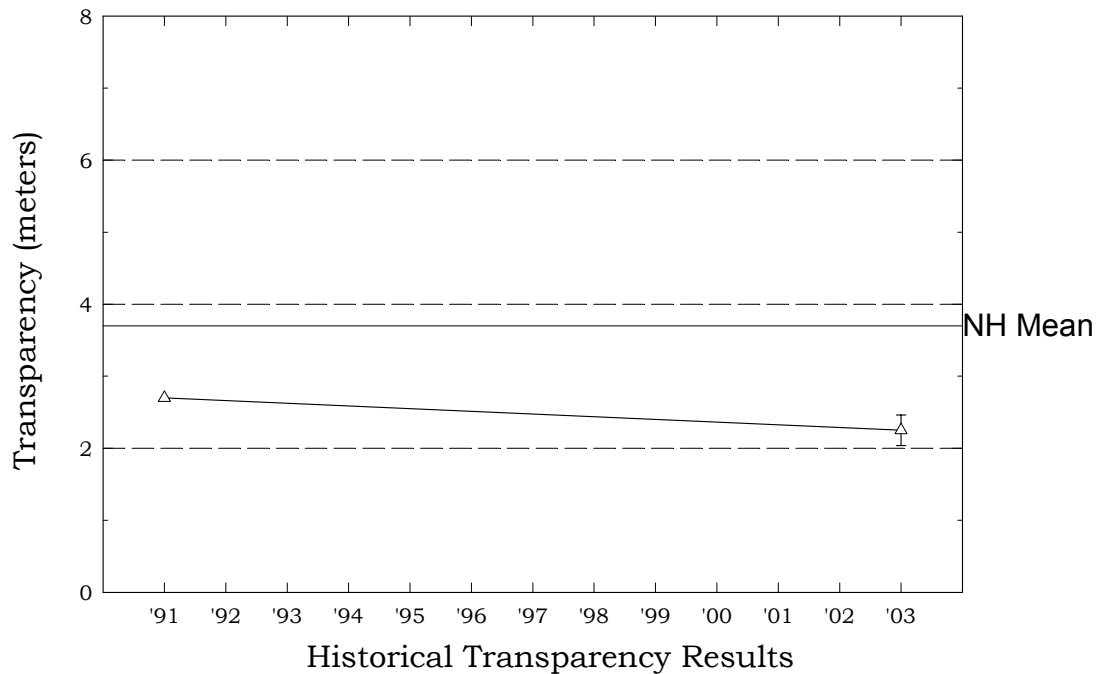
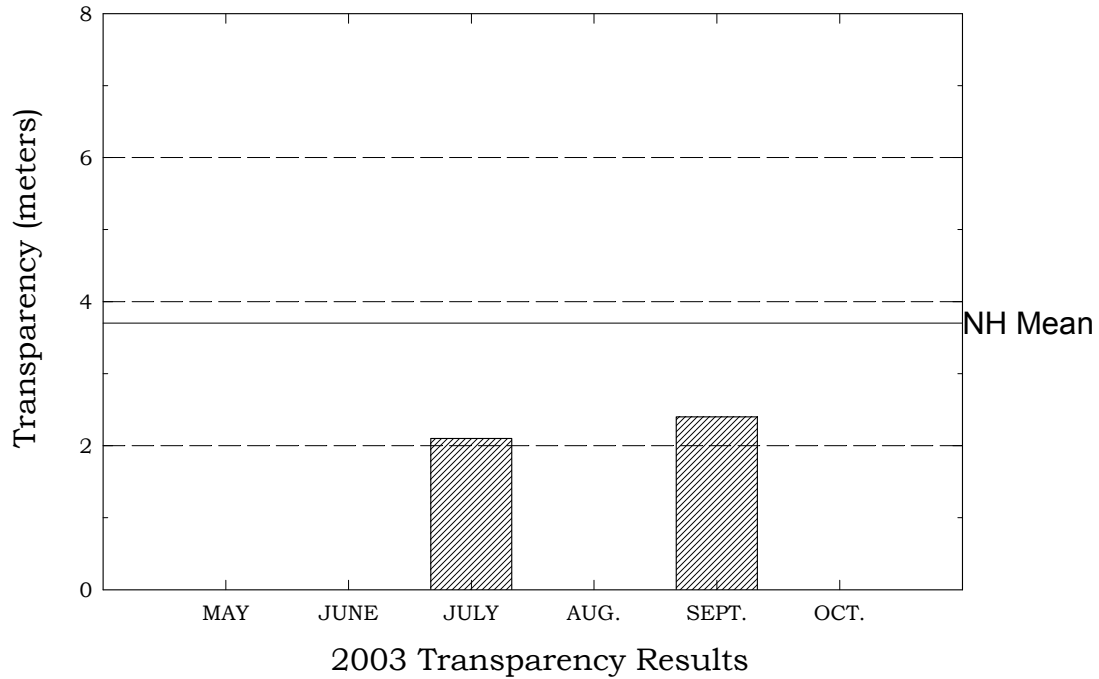
Back Lake, Pittsburg

Figure 1. Monthly and Historical Chlorophyll-a Results



Back Lake, Pittsburg

Figure 2. Monthly and Historical Transparency Results



Back Lake, Pittsburg

Figure 3. Monthly and Historical Total Phosphorus Data.

